



Philosophical Transactions

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PHILOSOPHICAL TRANSACTIONS.

February 10, 1682.

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Or the Anatomy of a Rattle-Snake dissected at the Repository of the Royal Society in January 1682 by Edward Tyson M.D. Coll. Med. Lond. Cand. & Reg. Societat. Soc.
An Account of some Books : I. Martini Lister è S. R. Lond. DE FONTIBUS MEDICATIS ANGLIÆ Exercitatio nova & prior. II. Jo. Alphonsi Borrelli Neapolitani Matheseos Professoris DE MOTU ANIMALIUM Opus Posthumum.

VIPERA CAUDISONA Americana ,
Or the Anatomy of a Rattle-Snake , Dissected at the Repository of the Royal Society in January 1682 by Edw. Tyson M.D. Coll. Med. Lond. Cand. & R. S. Soc.

THe Observations I shall here give are such as a single Subject would afford, not what might compleat the History of so Curious an Animal. And tho it were mightily to be wisht that we had at least the most accurate account, and exactest Anatomy, of one of every distinct Species of Animals; yet this can't be expected but of
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those that are most common ; where frequent repeated *Disections* might fully inform us of *Natures* admirable contrivance, and *Mechanism* of *Animal Bodies*.

This which We *Disectioned* was sent to Mr. *Henry Loades*, a Merchant in *London*, from *Virginia*; who was pleased not only to gratify the curiosity of the *R. Society* in shewing it them alive, but likewise gave it them when dead, and so afforded them an opportunity of farther satisfaction in observing the *inward parts* of it ; which I find so conformable in almost all respects to those of a *Viper*, that I have taken the liberty of placing it in that *Classe*, and (since it has not yet, that I know of, any Latine Name) of giving it that of *Vipera Caudifona* ; for as I am inform'd by Merchants, 'tis *Viviparous*, and the *Epithet* sufficiently differences it from those that have no *Rattle*, although of these too there ought to be made a Subdivision. But I shall concern my self at present only with the *Anatomy*, which I think is yet given by None ; tho to me it seems the most principal part in a *Natural History of Animals* ; and for other Accounts I shall refer to *Georg. Marcgravius*, *Gul. Piso*, *Johnston*, *Nierembergius*, *Joan. de Laet*, *Fran. Hernandez*, and others that have wrot of it ; who describe it under the Names of *Boigininga*, or *Boigininga*, and *Boiquira*, which are the *Brasile* Names. By the *Portugues's* 'tis called *Cascavela* and *Tangador* ; by the *Dutch*, *Rästel-Schlange* ; by those of *Mexico*, *Teutlacocauhqui*, or *Teutlacot zauhqui*, (i.e.) *Domina Serpentum*, and from its swift motion on the *Rocks* like the *Wind*, *Hoacoatl*.

But as to our *Business*, before we look within we shall take a short survey of its *outward parts*. This therefore that we *disectioned* was 4 foot 5 Inches long ; the girth of the *Body* in the largest place, which was the *middle*, was 6 $\frac{1}{2}$ Inches ; the girth about the *Neck* 3 inches ; near the *Rattle* 2 inches ; the Head flat on the top as is the *Viper*, and by the protuberance of the *Maxillæ* somewhat representing the head of a *bearded arrow* ; at the extremity of it were the *Nostrills*, † between them and the *Eyes*, † *Tab. Figs. a*
but

* Tab. 2.
Fig. 5. b.

but somewhat lower, were two other *Orifices*, * which I took for the *Eares*, but after found they only led into a bone that had a pretty large cavity, but no perforation. *Vipers* have not these *orifices* in the head; and *Charas* saith that they hear by the *Nostrills*; and that to them run not only the *Olfactory*, but *Auditory Nerves* also. The *Eye* was round, about $\frac{1}{4}$ of an Inch diameter; in Colour, the make of the *Pupill*, and other respects, like a *Vipers*, as indeed except in the *Rattle*, was the whole external shape of this *Animal*. There was a large *Scale* jetting over the *Eye*, which seemed to serve as a *Palpebra* for defending it from any thing falling on it; but I could not perceive 'twas capable of closing, tho' inwards it seem'd to have a *membrana nictitans*, which removes any dust that might adhere to the *Eye*.

The *scales* on the head were the smallest of any; those on the *Back* larger, and so proportionably greater to the biggest part of the *Body*; and so diminishing thence again to the setting on of the *Rattle*; all in figure somewhat resembling *Parfnip Seeds*. Their colour various; those on the *Head*, like the colour of the feathers on the back of a *Green-finch*; speckled with small black spots; whereof there were four larger and more remarkable. Those on the *back* were a dark *Feuille morte*, a black and a darkish yellow, and speckled, making a curious checker or dappling on the back by this intermixture of colours; but as they grew nearer the *Taile* they became darker, and at last almost *Black*. The *Scales* on the *back* had an edged rising in the middle, which was still less protuberant as they grew nearer the sides, where they were flat.

The *Belly* seemed flat, covered with long *Scales* of a yellowish colour, speckled black. From the *Neck* to the *Anus* we number'd 168; beyond the *Anus* were two half *Scales*; thence 19 whole *scales* of a black lead colour with yellowish Edges; from thence to the *Rattle* 6 orders or rows of smaller *scales* of the same colour.

The *scales* of the *Belly* were joyn'd to each other by distinct *muscles*; the lower *Tendon* of each *muscle* being inserted into the upper edge of the following *scale*; and the other *Tendon* of the same *Muscle* inserted about the middle of the foregoing *scale*. These * *Muscles* were more fleshy towards the middle of the *scale*; and then its *fibres* did run obliquely ascending. To each *scale* was appropriated a *Rib*, whose point did joyn with the extremity of it, which must much advantage the use *Nature* seems to design them for, by strengthening them to perform their *reptile motions*; for the *scales* are as so many feet, which being free, and open downwards, they thereby take hold of the ground, and so contract their *body* forwards, and then shoot out again, and so perform their *motion*. Whence tis observed by * *Nicrembergius*, that on *Rocks* their motion is much quicker, than on the *Earth*, or *Plains*; which he needed not to make a wonder of, since here they have the firmer footing. But in soft ground, tho their belly be flat, yet they can contract it to an *Ellypsis* or an *acute angle*, that so they may take the deeper hold, as I have observed in a *Viper*.

* Fig. 1. sss.

Since they must be always grovelling on the ground, 'tis a great provision of *Nature* in furnishing them with this coat of armor for their defence; which is so curiously contrived, that tho it covers the whole, yet by its frequent *joyntings* it admits of all *motions*. And for this too, the *vertebrae* of the *Spine* seem admirably contrived; there being a round ball in the lower part of the upper *vertebra*, which enters a socket of the upper part of the lower *vertebra*; as the round head of the *Thigh bone* does the *acetabulum* of the *os Ischi*, by which means it can turn it self any way.

Having placed it on its *back*, we opened it; and observed that the *Tendons* of the *Abdominal muscles* made a *linea alba* in the midst of the *scales* of the *Belly*; where likewise did run a large * *blood Vessel*, arising from the *Vena cava*, towards the lower part of the *Liver*. But not to be too

* Fig. 1. rr.

nice here, we proceeded to examine the *Viscera*, and shall here give the remarks in short, which I made of the *Wind-pipe*, *Lungs*, *Oesophagus*, *Stomack*, *Guts*, *Heart*, *Liver*, *Gall-bladder*, *Spleen*, *Kidneys*, *Organs of generation*, the *Sent-bags*, and then described the *Head*, the *Venemous Teeth*, the *Skeleton* and *Rattle*; and for the better Understanding the *Uses* of these *parts*, we shall often make a *Comparative Survey* of them with those of other *Animals*.

The *Wind-pipe* here was differing from that of most other *Animals*; which usually having their *cartilages* annular, or at least conjoyned by a membrane, do forme a *fistula* for conveying the *air* into the *Bronchiæ*; which thence is transmitted into the small *Bladders* of the *Lungs*. But * here, which is common with it to the *Viper-kind*, as soon as it enters the *breast*, presently meeting with the *Lungs*, it consists onely of *semi-annular Cartilages*, which being joyned at both ends to the *membrane* of the *Lungs* inwardly is quite open, and immediately transmits the *air* to the *Vesiculæ* of the *Lungs* as will better appear by the || figure. For dividing the * *Wind-pipe* we perceived it easily extended above $1\frac{1}{2}$ Inch wide; whereas before it meets with the *Lungs* the *Cartilages* are annular. The *Trachæa* or *Wind-pipe* was 20 Inches long, terminating near the *Heart* and beginning of the *Liver*, and reaching to that part of the *Lungs* which made the great bladder. The *Cartilages* of the *Trachæa* near the beginning were $\frac{1}{2}$ of an Inch, but toward the end $\frac{1}{4}$ of an Inch, and lying flatish from end to end. These *Cartilages* were not so distinct as in other *Animals*; but often running into one another.

The Use of the *Trachæa* is plain, for conveying the *air* into the *Lungs*; which how considerable an *Organ* they are Nature seems to shew us by the admirable *contrivance*, and *Largeness* of their *Structure*. They begin from the *Throat*, and run down 3 Foot in length. * The upper part of them that lay in the fore part of the body for the length of a foot, and did reach to the *Heart*, was made of small *Vesiculæ* or *Cells*, like the *Lungs* of a *Frog*: but from
the

* Fig. 1. aaa.

|| Fig. 4.
* a. 1. a. 2.

* Fig. 1. b.

the frequent branchings and checquer of the *blood vessels* there, appeared of a florrid red. This part tapers proportionably to the *Body*; the lowest part of it near the *Heart* moderately blown, was in compass $5\frac{1}{2}$ Inches; a little lower, for the space of 4 Inches, the *Cells* gradually disappeared; so that they seemed at last to form only a *reticular compages* of *valvulae conniventes* on the inside of the *membrane* of the *Lungs*; and the compass of the greatest place here was about $6\frac{1}{2}$ Inches; but from thence to the end of the *Lungs* was only a large* *Bladder** cccccc. without any *Cells*; composed of a thin, but strong transparent *membrane*, the compass of which blown as the former was $8\frac{1}{2}$ Inches.

The *Lungs* of the *Salamandra Aquatica*, and some other *Animals*, are only two large *bladders*. In the *Frog*, *Crocodile* &c. are two large *lobes*, filled with *membranous vesiculæ* or *Cells*. Our *Rattle-Snake*, and all that *Family*, tho they have but one *lobe* of *Lungs*, yet in that they comprise the 2 former Sorts; the fore part being filled with numerous *Vesiculæ*; the later an entire large bladder.

In the *land-Tortois* there are two *lobes*, one on each side; but these are subdivided into several others, according to the partitions of the *Ribs* that are fixed to the *shell*; and they ly chiefly in the *belly*, that is, the lower part of the body. But what I would remark is, that where the *Bronchiæ* first enter these subdivisions 'tis *reticulous*; then they form a large cavity: so that in these *Animals*, where the *nixus* of *Respiration* is not so frequent, *Nature* provides a sufficient store-house for this (so necessary a *Pabulum vitæ*) in these larger bladders, whence 'tis dispenced according to the exigency of the *Oeconomia Animalis*. For the *Tortois*, *Viper*, *Rattle-snake*, *Frogs*, *Toads* &c. which sleep a great part of the year; as before they betake themselves to this repose, they take in their store of Food; so perhaps that of *air* too, a more constantly requisite supply of *Life*. For when thus stupidly *asleep*, and sometimes to all appearance *Dead*; it may be question-
ed

ned whether they have any *motion* of those parts, which is required for drawing in fresh Air in inspiration. But since their life here is so imperceptible and small; this stock may be sufficient, the decay being so little. So the *Salamandra aquatica*, that lives under water, for Lungs has two large *Bladders*, not unlikely for this Reason; that it might not be forced so often to raise it self out of the Water to breath in fresh air when the former is spent and decayed.

In a *Viper* I lately Dissected, which remained alive some daies after the *Skin*, and most part of the *Viscera* were separated, I observed the *Lungs* all this while not rising and falling, as in *Inspiration*, and *Expiration*, but constant, equally extended with *Air*; that as soon as it dyed, it expired, and they fell. But the *Stomack* was empty, and I doubt not was so some considerable time before; as was the *Rattle-Snake's*, which for 4 Months at least had eaten nothing: so that although they can live so long without *Food*, yet *Nature* is mighty provident in supplying them with *Air*, in bestowing on them so large *Receptacles* for receiving it. So the *Ephemeron*, the *Silkworm* and other *Butterflies*, which all their life time, when in that state, do not eat, or take in any food, yet have their *Bronchiæ*, or *Lungs*, remarkably large, and numerous, as if they were sufficient alone for maintrining their *Life*, for if they be occluded with *Oyl*, or otherwise, they are strait suffocated, and dye convulsed.

But wee shall now take notice of those parts that are for receiving the *Food*; And first of the *Oesophagus*, or *Gula*, which serves for the transmitting it into the *Stomack*; and indeed this seems the only use of this part in most other *Animals*; but here *Nature* may be thought to intend it for something more, and to make use of it upon occasion as a *Stomack*, or *Stomacks* too; for upon blowing
 † Fig. 1. d f. up this part, I observed two large swellings, as represen-

b Narrant multi, qui eum Serpentem domi alere solent atque educare, annum integrum durare absque cibo nullo potuque, Nicremberg. Hist. Nat. l. 12. cap. 1

ted in the *Figure*; nor was the true *Stomack* capable of that *extension* as these were. The whole length of the *Oesophagus* was two Foot $3\frac{1}{2}$ Inches; the length of the proper † *Stomack* 5 Inches, lying in a straight line with the *Oesophagus*; but thicker than it, having a remarkable coat more on the inside, easily distinguishable by its colour, substance and *Plicæ*, and jetting over the inside of the *Gullet*; and in all respects as in the *Viper*. From the *Pylorus* the * *Ductus* straitened again for $1\frac{1}{2}$ inch; and then formed a large || *Intestine*, which afforded a pleasant sight, by || *Fig. 2. g.*
the *weaved Rugæ* of its inward coat; which Gut after some small windings, ended at last in the † *Rectum*, † f f f. *etc.*
whose capacity was much less than the former. In the *Stomack* and Guts I observed abundance of *Lumbrici teretes* which is a disease *Vipers* likewise are subject to. The whole length from the *Throat* to the *Anus*, is but a continued *Ductus*; tho oft variously distinguished, according to *Natures* different intention in the several species of *Animals*; in none tis so plain and Simple, as in the *Atus Marinus*, where you have neither *Oesophagus* or *Stomack*, but only a straight passage, and that too without any valves, only growing a little more taper towards the *Anus*. In other Fish there is no *Oesophagus*; in some but a very short one. In other *Animals* tis not only long, but by its swellings in some places, has acquired different Names, as the *Ingluvies*, or *Crop* in Birds; the *Paunch* or *μεγάλη κοιλία* in *Quadrupeds*; and what use they do perform the same I take these swellings in the *Gullet* of the *Rattle Snake* to doe likewise; they being convenient receptacles for retaining what Food the *Stomack* cant yet well receive; and here it seems the more requisite, since they feed but at one time of the year.

But since in that promiscuous food they take, in which they swallow always whole, there are often some parts unfit to be digested, and therefore to be returned again; the *Gullet* here being very long, and upon that account incommodious for this action, Nature has provided these swellings

ings in it, where they may be respited, till recouating its force, it gives them another lift, and upon a Third effort at last wholly ejects them. And if what is confidently reported by many, be true, that on occasion of danger they receive their young into their *Mouths*, these are fit places for receiving them.

The food before it can prove aliment, must be comminuted, and broken into the smallest particles; which in these membranous *Stomacks*, I can't see how it can be performed, but by corrosion.

A principal *menstruum* in doing this, I take to be that liquor, which is discharged by the *Glands* that are seated in some part at the begining of the Throat, and are called *Saliva*, or just above the Stomack or *Gizzard* of Birds, and called the *Echymus*, or in others in the Stomack its self, and called the *glandulous coat*; and such I take the inward coat of the *Stomack* of our *Rattle-Snake* to be.

When comminuted tis discharged into the *Guts*; which that the *Chyle* might not pass off with the *Fæces*, are often
 * *Fig. 2. ecc.* convoluted, or winding as * here; that so by impeding a too quick descent of it this way, or by *Valves*, a separation may the better be made; and then the *Fæces* as useless, can't quicker be discharged than by the *rectum*; which where the *Fæces* are hard, is furnished with a stronger *muscle* the better to help its *action*; and such seemed the *rectum* here; and the *Fæces* harder then usual in *Vipers*.

So that the whole *Ductus Alimentalis* from its uses, may ordinarily be divided into 4 parts. 1 That which conveys the Food, the *Oesophagus*. 2 That which digests or corrodes it, the *Stomack*. 3 That which distributes the *Chyle*, the *Intestines*. 4 That which empties the *fæces*, the *Rectum*. But a *Leech* is all *Stomack*, from one end to the other, and do's devour at a meale several times the weight of its whole body: The *Stomack* when swell'd and strecht with blood is far bigger than the *Leech* it selfe; nay several times exceeds it. But I mistook the number, it was not one, but many *Stomacks*; for the cavity is divided by several

transverse membranes, into divers distinct *Camera's*; but these membranes in the middle have a hole that leads from one into the other: but by the pouching out of each side, each of these may be reckoned also two; in all we may number, (there being 10 or 11 of these *Camera's*, besides those 2 long ones which at last run to the *tail*) at least two, if not four and twenty *Stomacks*, but the *Rectum* which lyes between the forking of the 2 last long *Sacculi*, or *Stomacks*, is but small, and short in respect of the whole; but of this perhaps more in my *Anatomy* of this *Animal*. To proceed

We shall next take notice of the † *Heart*, which was placed near the bottome of the *Trachæa*, on the right side of it. The length of it was $1\frac{1}{2}$ Inch, its figure rather flat than round; encompassed with a *Pericardium*, and the * *Auricle* larger than the heart it self. It hath but one *Ventricle*, the *valves* small, and fleshy: and the inside of the *Ventricle* distinguish'd by 4 or 5 cross furrows. Why *Charas* should make the Heart of the *Viper* to have two *Ventricks*, I see no reason; I should much more easily allow a double *Auricle*, one at the entrance of the *Vena cava* of which there are two || branches descending and one ascending: the other for the *Arteria Aorta*, which has two ascending and one descending □ branch as in the □ figure.

A little below the *Heart* lies the * *Liver*; which was about an Inch wide in the largest place, and seemed divided on one side by the *Vena cava* into two lobes of an unequal length; for that on the left side was about 10 Inches, and that on the right side about a foot long; its colour a brown red, and its use no doubt for the separating the *Gall* that was contained in a † bladder seated at some distance below it. It was once the opinion of *Sylvius*, that the *Gall* was transmitted hence into the *Liver* to be mixed with the blood, and not there separated from it; but what the famous *Malpighi* wrote to the contrary, in a great measure brought him off it: and our Subject here, is an

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† Fig. 1. K.

* l.

|| n n n.

□ m m m.

* o o.

† p.

*Fig. 19 2. c. Argument against him, where the *Gall Bladder* is placed so remote from the *Liver*, and the * *Ductus* for conveying it into the *Intestine*, is so evident, whereas that which brings it from the *Liver* is more obscure, and hard to be found. The *Gall-bladder* here was 2 Inches long, the colour of the Gall contained in a grass-green, which sweating through it's coates had deeply tinged all the adjacent parts, the tast of it in a *Viper* which seems the same, for I did not tast it here, was first salt, then a sweet bitter.

□ d. The *Ductus Cysticus*, by which it emptyes it self into the *Intestine*, arises from the top of the Bladder; so gently descending passes through that part which *Charas* takes for the □ *Pancreas*; but which the Ancients called the *Spleen*, and so enters the beginning of the large *Intestine*.

Indeed in *Vipers*, the Colour of this part and situation so neare the *Intestine*, seems an Argument for *Charas* his conjecture, for he modestly proposes it as such; but here in our Subject, it's Colour which was deep red, and such hitherto I have observed the *Pancreas* to be in no *Animal*, as likewise its figure, not spreading but more compact, these seem to favour the Opinion of the Ancients; I shall move no contraversy about this part, which has made so many with all *Anotamists*; having little to say of it, but that 'twas about the bigness of a large bean; that it adhered to the side of the *Intestine* at the begining of it; and that through the middle of it, as is already observed, the *Ductus Biliaris* did pass. I was taken off from a farther Scrutiny into this part by the ravishing beauty of another, I shall presently describe, the *Kidneys*.

But I must first observe the Fat which was very plentiful and is said by ° *Nardus Anton. Recchus* to be used by the Physicians of *Mexico* with good success, in the *Sciatica* and all pains of the Limbs, and for discussing preternatural Tumors.

The Membrane it adhered to, I take for the *Omentum*;

which encompassed all parts contained in this lower *Belly*; and was joyned to both sides of the *Ribs*, so running to the *Rectum*, and forming a bagg that inveloped the parts here, but was free, and not conjoyned towards the *Belly*. The lower *Belly* I call it to distinguish it from the rest of the *Trunk*, for the whole was but one continued cavity; there being no partition of it by any *Diaphragme*; and I have represented the parts contained here, in my *second Figure*, as the others are in the *First*; but proportionably much larger as appears by the Descriptions.

For the two *Kidneys*, which lay to the back on each side of the *Spine*, but not very firmly conjoyned, were about 7 Inches long; that on the right side something longer than the left; and about $\frac{1}{2}$ Inch broad each; tho one continued body, yet plainly distinguishable into several lesser *Kidneys*, as I remember in one I numbered 15, but all so very curiously contrived and with so great beauty, that I want Words to exprefs what the *Pencil* could not imitate, much less can be represented in a *Print*. I shall therefore in my Description, the better to help out and illustrate my meaning, have a constant reference to the *Figures*; which being covetous of making as well as might be, spent so much time, that I had not an opportunity of satisfying my curiosity in all respects (the parts drying) as I desired; but did observe, as likewise several *Others* who viewed them, when first taken out of the body, that the whole seemed a delicate *Compages* of vessels, and the intermixture of those of the blood, with those other white ones, that are the *Secretory*, composed most regularly formed Bodies. In my* *figures*, That on the left side represents the upper *superficies* of the *Kidney*, which appears first in the *Dissection*; the other, the lower side which lyes to the back; in both there are two large *blood vessels* running down each side: one marked (*n n n*) the other, where the *vas deferens* runs; but is not here represented; and from these arise several lesser branches (*o o o*) at set distances, which curiously spreading themselves do forme

* Fig. 2.

as it were *ramifications* of *Trees*. As many as there were of these *emulgent vessels* (for so I take them to be) so many *Kidneys* were in each; the *Interstices* (*p p p*) of these *blood vessels* were filled up with other *White* ones; which I doubt not are for the *secretion* of the *Urine*, and on this side did appear more numerous, than on the other; but tis impossible to represent the curious interweavings of both; but here in the under side of the right *Kidney* in some places they appeared more distinct; for (*Q Q*) shews the large *blood vessel*, whence arises the *Emulgents* (*r r r*) which spreading themselves very thick into the *bodys* (*s s s*) make them appear all bloody, between which for a little space there appears a small body of the *White Secretory vessels* (*t t t*)

This curious structure of the *Kidneys*, and peculiar order of the *vessels*, do further confirme me in my opinion concerning the make, and fabrick of these parts; but having at large delivered my thoughts hereof, in my *Adenologia* or *Discourse* concerning the *Glands* of the *Body* which it may be I may hereafter publish; I shall not at present further insist upon it: but shall only remark, that in *Birds*, *Fish*, and *Reptiles*, the *Kidneys* are usually long; in other *Animals* often more compact; the several *Glandulous bodys* that compose them, being conglomerated, and closer set together, tho in some they appear perfectly distinct: as the *Bear*, the *Otter*, the *Porpefs*, *Ostridge* &c. and as I have remarked in the *Porpefs*, in each of these there may be observed distinct *Emulgents*, *Ureters*, *Pelves*, a *Cortical* or *Glandulous* part, and the *Corpus Papillare*, which is made up of the *Tubuli urinarij*, which convey the *Urine* into the *Pelvis*. And the *Kidney* in a man tho it seems but a single one yet it is really made up of as many, as there are *Corpora Papillaria*. So here in our Subject, tho the Substance of the *Kidney* seems continued, yet there ought to be reckoned as many as there are distinct

systems and *Orders* of *vessels*; each making a peculiar *gland* or small *Kidney*; which according to the advantage of the body of this *Animal*, are placed here at length, not piled on one another. The use of them is for carrying off the *Lixivial* and superfluous *Serum* of the blood, which is of so great consequence, that even those *Animals* that drink not at all, or but very little, yet by Nature are furnished with them, as the *Rattle Snake* may be thought. When the separation of this humour is made in the *Kidneys*, 'tis conveyed thence by the *Ureters*, into a bladder, if the too frequent exclusion of it might be inconvenient to the *Animal*, or if it be made in lesser quantity, into a *Cloaca*, just at the *Anus*, and so to be ejected.

The *Ureters* in our Subject did run almost the length of the *Kidneys*: being a common *Trunck* that received the lesser *Branches* that went to each single *Gland* (it is in part represented by the * letters [*v. v.*]) and did both terminate near each other in the *Cloaca*, making a rising there; for our *Rattle-Snake*, like *Birds*, had a *Cloaca*, which in the female *viper*, receives the *Orifices* of the *Ureters*, and the two *Uteri*; and in part may be said that of the *Rectum* too, which yet had a convenient *Valve* that covered it.

* Fig. 2

Near the *Verge* of the *Cloaca*, we observed two other orifices which seemed covered by the folding of the *Skin*, and these led into those two † *Baggs* which I have taken the liberty to call the *Scent-baggs*. *Charas* is much mistaken, who supposes them to be the *Parastates* or *Conservatories* of the *Seed*, as likewise those he would refute that would have them to be other *Testicles*: and I the more wonder at this his mistake, since he could not but have observed them as I have in the female *Vipers* too; which sufficiently shews his error. One of them was about an *Inch* long, and as big as a *Goose* quill, but *Taper* towards the end, and from the colour of the *Liquor* it contained, appeared darkish; the other *Bagg* was something less, and its colour

+ Fig. 2 m.

colour as in the *Viper*, This difference I suppose may be accidental: The Liquor included in them was something crass, and of a strong and very unpleasant Smell; such, but in a more intense degree, as the Animal did emit before dissection, which ^d *Martial* likewise takes notice off, having placed it in the last but one in his Catalogue of Stinks, where he saith

*Quod Vulpis fuga, Viperæ cubile,
Malles, quàm quod oles, olere Bassa.*

And *Jo. de Laet* makes mention of some Snakes in the *West Indies* that stink worse than any *Fox* or *Pole-cat*.

I have long since taken notice how the *Factors* of all strong scented *Animals*, are collected in these *Baggs*, but designing ~~there~~ may be hereafter a farther Essay on this Subject; I shall not here enlarge upon it: Only take notice, that our common Snakes have a far greater *Factor* (Which lyes in the same *baggs*) than our *Adders* or *Vipers*. And I have been told by Travellers, that some *Crocodiles* will leave a strong, but gratefull Smell behind them: which if so I doubt not, but it may be upon the same cause. But usually tho this Liquor when new, and in great Quantity be offensive, and of an ill smell (and such is *Civet* likewise which is nothing else) yet when dry and in lesser Proportions it may prove more gratefull. Thus the liquor in the *Scent baggs* of a *Weasell*, being dryed, on a Paper and kept some time, did not seem unpleasant to me; but rather the contrary: and I see no reason why *Pole-Cats* may not be *Civet-Cats*, though they may not turn to that account. But in a *Lyon* I dissected, the Liquor contained in the *Scent-baggs* was in the opinion of all that smelt it, much like that of Oyl of *Anise* or *Fennel seed*; which almost was the only difference I could find between the *Lyon* and a *Cat*; for in a *Cat* this Liquor is scented.

d *Martial*: l. 4. *Epigr.* 4. e *Hist. India Occident.* l. 15. c. 6. p. 555.
f In *Dr. Plois Natural Hist. of Oxfordshire.* c. 9. p. 305

But we shall now come to the *Organs of Generation*: and I find that *Charas* is as unhappy in the Description of some of them, as he was in his conjecture about that part, we call the *Scent-bagg*. We shall begin with that, wherein the *Seed* is first made, the * *Testes*, which are very unproportionate in length; the *Right* being $2\frac{1}{4}$ inches long, the *Left* but $1\frac{1}{4}$ inch long, scarce so big in compass as a Goose-quill. The unequal length of this part *Charas* takes notice off in *Vipers*. I shall add, that the *Ovarium* of the *Female Viper* is the same; for that of one side was as big again as the other. The colour of the *Testes* was white, as is usual, and so was their Substance. I did take notice of the *Vasa preparantia*, which had nothing uncommon: But the † *Deferentia* were remarkable; for tho they did run in a strait line almost from the *Testes* to the *Penis*, and did form no large body, yet this *Ductus* was so often involv'd, that were it unravel'd and extended it's whole length, 'twould be twice as long: which made me think, that it was only the extension of the *Epididymus*, for the whole *Testis* is but a *Cengeries* of curiously convoluted *Vessels* which terminate in the *Epididymis*, whose continuation makes the *Deferens*: and where it's convolutions are many upon the *Body* of the *Testis* itself, there the *Deferens* is an even *Ductus*; but as in our subject it making no such body there, or but a very small one, in its passage downwards it was every where crimp'd, and about the middle of the *Kidneys* often convoluted, which is represented in our Figures.

Where they emptied themselves I could not so well observe in the *Rattle Snake*; Since the parts which I had laid out for making the *Scheme* soon dried before I had an opportunity of nicely examining them. But since upon the dissection of a *Viper* I found that they † were continued along the *Penis* single, where the *Penis* was so; and afterwards divided, and did run to the end of each. Nor were there any *vesiculæ seminales* or *Prostates* here to receive them; and a reason for it I shall alledge when I have

* Fig. 2. A.

† JJ.

† Fig. 3. A.

* Fig. 2. K. have described the* *Penes* which here were very remarkable, not only for their structure, but number likewise, there being 4 in all, two on each side, which lay sheathed in the Body that upon first opening it they were not to be perceived, but only the large *Orifices* where they were drawn in as a finger of a Glove may be by a thread fastned to the end. But having protruded them by a *Probe*, they appeared as is represented in the || Figure. And I did observe that toward the *Basis*, or *Root*, they were single of each side, and that here they were thick beset with prickles, whose points looked backwards, and were very sharp, and seemed, especially when dry, like the substance of the *Bristles* of a *Hedg-hog*: but hence they were divided, and did form two round bodys, of the bigness of a small Goose quill, about $\frac{1}{4}$ of an Inch long of a red Colour, but the whole, as protruded, was above an Inch long. When protruded I found they could easily be retracted, and drawn in by the help of large † *Muscles*, that were fastned to them and did run along under, and were at last inserted at the end of the *Tayle* at the setting on of the first *Rattle*; which upon the trial was so plain that we need not doubt of the use of them, and I shall therefore call them *Retractores Penum*. But *Charas* seems to mistake them in *Vipers*, for the *Penes* themselves; which he describes to have their Origine from the extremity of the *Tayle*; as does * *Baldus Angelus Abbatius*, † *Olyss. Aldrovandus* and others who it may be misled him in the account of these parts. Nor as to the other extreame are they more in the right, which by their Picture, and Description, they make to be altogether single, and covered and quick beset with Prickles like the Skin of a *Porcupine*. Whereas this part in *Vipers* too, as well as in the *Rattle-Snake*, divides and forms two large round bodys, or two distinct *Penes*. And this *Baldus*, or rather *Camentius* who made the dissection for him, seems to

g De *Viperæ natur. & facultat.* cap 19. pag. mibi 60. In *Aldrovandus de Serpent. & Dragon.*

have observed where he saith, *Quando turgidi fiunt, aut extra violenter emittantur, uti sæpe apud Paulum vidimus, Penes hanc formam referre Y aspectu aspero ut Erinaceus.* For in *Vipers* they are Hispid to the end; but not in the *Rattle-Snake*, as is plainly represented in the figures of both.

There are several Animals have no *Penis* at all, but *Vasa deferentia*, as most *Fishes*. All *Quadrupeds* that I know of have but a single one. Some *Birds* have but one. Most others if they may be said to have any have two but very short. In *Crabs*, *Lobsters* &c. there are two long ones, one on each side; but *Earth-worms*, *Leeches*, *Shell-snails*, &c. are *Hermaphrodites*, and have the perfect Organs of both Sexes. But where the Sex is single, the *Rattle-Snake* and that Family have these Organs of Generation the most numerous of any I have hitherto met with. But why the Male *Rattle-Snake*, or the Male *Viper* should have 4 *Penes*, when the Female has but two *Uteri* for receiving them, seems a difficulty to me. Amongst many Conjectures I have had about it, what seems the most to satisfy me, is this: That they have the *Penis* here on each side double, or forked, that so being enter'd the *Uteri*, by spreading themselves like the *Pythagorean Y*, they may the better and more firmly be retained there till they have performed their Duty. And this too seems one use of the *Aculei* or *Bristles* towards the Root of them; for having their points looking backwards when once they have enter'd the *Pudendum*, they must needs lock them in, and retain them there, till such time as the parts being tired, and subsiding, have leave to retreat. For in Animals which have no *Vesiculæ Seminales*, 'tis requisite that the *Coitus* belong, that so the Seed which cannot quickly, may leisurely be transmitted from the *Testes*: but where 'tis before hand stored up in the *Vesiculæ*, there the *Coitus* is soon over; but when they must expect the Generation, or at least a sluggish descent of it, Nature makes provision for the more convenient performing it. So in *Dogs*, which have no *Vesiculæ seminales*

feminales, near the Root of the boney *Penis* there is a large body made up of an abundance of Cells and Vessels; which upon the rushing in of the blood, and spirits, is so mightily extended, and swelled, that it forceably keeps him in, 'till such time as the *Impetus* be over, and the part subsides. So the *Lusip-fish*, on its Breast has a large round body curiously contrived, like the tail of a *Leech*, or the *Acetabulum* of the *Polypus*; by which it can firmly adhere to the Female, and so by this means, tho its *Penis* be very short, yet be able to perform a *Coitus*. *Cats*, *Lyons*, &c. which have likewise very short *Penes*, that they may the better cling, are forced to make use of their Teeth, and Claws, and from the pain of these, not from the scalding of the Seed, come those fierce screams, and hideous youlings.

Therefore in our *Rattle-snake*, (where, as we have observed, there are no *Vesiculae*, and where the *Vas deferens* is all along crimped and winding; and so upon both accounts must be thought to be long in *Coition*) the contrivance, and structure of these parts seem very requisite. For altho in this action they twist their body, which may be some advantage too, yet not sufficient alone; for otherwise upon a little occasion the parts would be apt to slip out, which now they cannot, being forked, and hooked in too by the *Aculei* or Bristles. But the *Deferentia* being continued to the end of the *Penes* do likewise shew this must be the use of them. But that the Female may recieve no injury by these *Spines*, Nature has made that part of the *Uteri* which they enter strong and gristly; as we observed in a *Viper*: and that the Male too might not be harmed by an over Extention of these parts, those strong Muscles which serve for retracting and drawing them in, do likewise secure them in this respect too. It may be likewise considered, since they are naturally so cold and frigid, whether these *Aculei* may not serve to incite them, and stir them up. But we shall pass off from these parts, that serve for increasing themselves, to those that

often prove the Destruction of Others, *The Paysonous Teeth.*

But first I shall remark something of the other parts in the Mouth: as the *Tongue*, the *Larynx*, and the smaller *Teeth*: and in General, that the Head was but small, yet the *Rictus* was very large, but the Reason of it we shall give when we speak of the *Bones*. And as to

The \dagger *Tongue* it was in all respects so like that of the *Vi-* \dagger *Fig. 5. g.*
per, that the Description of the one may suit the other. 'Twas composed of two long round *Bodys*, contiguous and joyned together from the Root $\frac{2}{3}$ of it's length; with great Agility they could dart them out, and retract them again; and that part which appeared out was of a black Colour, whereas that which lay sheathed within was Red: for 'twas fastened below the Throat, and thence was covered with a *Vagina*, or sheath, to the place where it issues out, which was near to the End of the *Larynx*; and for the better Ejaculation of it, the under *Jaw* too was here * divided, leaving a considerable space. For * *Fig. 5. j.*
 if 'twere conjoyned as in other *Animals* and beset with Teeth, they would be apt to injure the *Tongue*; or at least it might prove incommodious to the use 'tis designed for, which in part I suspect with *Charas* to be for catching Flies, and such small Creatures they have a mind to devour. But *Jo. Baptista Hodierna* thinks 'tis rather for picking the dirt out of their *Noses*, which would be apt else to stuff them; since they are always grovelling on the Ground, or in Caverns of the Earth.

Over the \parallel *Tongue* did lye the *Larynx*; not formed \parallel *Fig. 5. f.*
 with that variety of *Cartilages* as is usual in other *Animals*; but so as to make a Rime or Slit for receiving or conveying out the Air. Nor was there any *Epiglottis* for preventing other bodys from slipping in; this being sufficiently provided for, by the strict closure of them: And the Air passing through only such a slit, without the contrivance

of other parts for modulating it, can only make such a sound as we observe in their hissing.

† Fig. 5. c c. h.

* Fig. 5 d d.
Fig. 6. h.
Fig. 7. i

The *Teeth* are of 2 sorts, † 1. The lesser, which are seated in each *Jaw*, and serve for the catching, and retaining the food. 2. The *Poysonous* * *Fangs* which kill it, and are placed without the *Upper Jaw*, ^{they} are all *Canini* or *Apprehensores*; for since they do not chew or bruise their Food, but swallow all hole as they meet with it, there is no need of *Molares*.

Of the first sort of *Teeth*; In the *Lower Jaw* there are two Rows on each side, 5 in a row, the Inward lesser than the Outward, so that there are here 20 in all: In the *Upper Jaw* there are but 16, 5 on each side placed backwards and 6 before. These do no harm, which was known to *Mountebanks* (as *Cisalpinus* and others observe) formerly; who to give a proof of the force of their *Antidotes*, would suffer themselves to be bitten by *Vipers*, but first took care to spoil them of their *Fangs*.

|| Fig. 6. g.
† f.

These *Fangs* are placed without the *Upper Fangs*, towards the forepart of the mouth, nor fastened to the *Maxilla*, as the other *Teeth*; but the || two outmost and largest *Fangs* were fixt to that † *Bone*, which if any, may be thought to be the *Eare Bone*. The other *Fangs* I could not perceive were fastened to any *Bone*, but to *Muscles* or *Tendons* there. These *Fangs* or larger *Teeth* were not to be perceived upon first opening the Mouth, they lying couched under a strong *Membrane* or *Sheath*; but so as did make a large rising there on the out side of the *Lesser Teeth* of the *Maxilla*; but at pleasure when alive they could raise them to do execution with; not unlike as a *Lyon* or a *Cat* does it's claws. These *Teeth* were hooked and bent like the *Teeth* of a *Barbarossa*; but some of the * smaller of them were bent at *Right Angles*; but their shape and bigness will be best understood by the * Figures we have made of them. On each side we met with about 6 or 7 not altogether placed so exact as is represented in the Head in the 5 Scheme; which was don for the shewing

* Fig. 7.

shewing them more distinct. For the 2^d *Tooth*, upon raising it, did lye more on the side of the first; and the other being fastened only to *Muscles* or *Tendons* which are flexible, 'tis difficult to assign them their posture. In all these *Teeth*, especially the larger, we took notice of a pretty large *Foramen* or Hole towards the Root of it, and towards the point there was a plain visible and large Slit, like the cut of a Pen sloping; and that part from the Slit to the Root was perfectly hollow; which first of all was discovered to us, by pressing gently with our finger the side of the *Gumme*; for then we did perceive that the Poyson did readily arise through the hollow of the *Tooth*, and issued out of the *Slit*. This we tryed several times; which tryals, as likewise our searching for all the *Teeth* we could here find, did spoyl our Enquiry into the *Baggs* and the *Glands* that furnish them with that Liqueur. But our defect herein may well be supplied with what *Mons. Charas* and *Sen. Redi* have wrote of the same parts in *Vipers*. Nor do I think there may be any material difference as to these particulars in both Subjects. This poyinous Liqueur I observed to be of a Water colour, lightly tinged Yellow; perhaps in some it may at sometimes be deeper: & this, it may be, has given occasion to that fond Opinion of those who have imagined that it was transmitted by a Vessel from the *Gall bladder*. Indeed scarce any Subject in Philosophy has admitted more controversy's than this of the Poyson of *Vipers*; in what it consists, what it is, and how it produces it's dire Effects. *Severinus* in his *Vipera Pythia* has made a large collection of them; and who so pleases may there satisfy their curiosity about it. But of late, famous has bin the contest between *Sen. Redi*, a Noble *Italian*, and * *Mr. Charas* a *French-man*. 'Tis *Redi's* opinion, 'That the Yellow liqueur contained

k Vid. Fr. Redi obser. de Viperis ejusd. Epist. ad Aliquas oppositiones in suis Observat. Mr. Charas New Experim. upon Vipers. A Continuation of the new Experiments by Charas.

' in the *Vesicles* of the *Gummes* of the *Vipers*, is the only
 ' and true seat of the Poyson ; That this *Juice* is not vene-
 ' mous, when taken in at the mouth, but that it is so, when
 ' let into wounds made by a *Viper* whilest she is alive, and
 ' even in those which she may be forced to make several
 ' daies after she is dead , provided the Yellow Liquor do
 ' intervene; That the same Liquor drawn from a live *Viper*,
 ' as well as that of a dead one. is alwaies Venemous, if let
 ' into the wound, and mingled with the blood of the Ani-
 ' mal wounded , whether it be used when liquid, or after
 ' it is dried, and reduced to a Powder: and that it kills
 ' all kind of Animals, into the wounds of which it shall
 ' have bin intromitted. But Mr. *Charas* wholly opposes
 ' this, and asserts, ' That the Poyson of a *Viper* is no where
 ' but in her intraged Spirits ; That the Yellow *Juice* as wel
 ' of a live *Viper* , and even a vext one, as of one that il
 ' either newly dead, or hath been so for several daies, cons
 ' tains in it no poyson at all ; neither taken inwardly, nor
 ' in the biting, nor put into the wound, nor mingled with
 ' the blood, nor any other way wherein it may be used :
 ' That it kills nor infects no kind of Animals, and that it
 ' is nothing but a meer innocent *Saliva*. Both insist upon
 Experiments for the proof of their own opinion, which be-
 ing sufficiently known, I shall not here repeat , or inter-
 pose in the Controversy , but, shall only offer that where-
 as¹ *Charas* makes this Liquor to be a meer *Saliva*, and that
 ' it serveth not only to moisten the Ligaments, and to
 ' make them fit for the bending of the Teeth, but also to
 ' nourish them, and to make those grow that are there, as
 ' it were in a Nursery ; and are, if we may so say, in ex-
 ' pectation to serve instead of the many Teeth, whether
 ' these come to fail in their force, or fall out of themselves.
 This I think is not so well asserted , the offices of the *Saliva*
 being others ; and it seems no way proper for Nourish-
 ment of the Teeth : nay, the Fabrick of the Teeth makes

1 *New Experiments upon Vipers*. p. 27. *mibi*.

more for Senior *Redi*'s opinion, they being thus hollow, and having that large slit towards the end, and this *Juice* so readily and naturally issuing through them; this seems to me to argue, that Nature designs it for other uses than Nourishment, for if so, by giving them so large a vent she would be frustrated of her end. But they being so sharp and strong at the ends, and the slit too plac'd towards the back, not inside of the Tooth; what can be more conveniently contriv'd both for making the wound and infusing the Poyson? For if the slit was inwards, by the struggling and withdrawing of the Animal assaulted, this slit would be apt to be stop't and occluded; and the descent of the poyson prevented; but being thus formed, it gives a greater advantage for its infusion. Thus the *Scorpion*, the *Bee*, the *Emmet*, nay the Sting of a *Nettle*, at the same time they make a wound, they leave behind them a drop of liquor, which excites those dreadful *Symptoms*; whereas the wound without it, would be inconsiderable. For *Nierembergius*, or rather *Hernandez*, from whom he transcribes the whole History of this *Viper*, tells us; *Caninis in usus Medicos servatis pungunt Mexicani Medici collum, cervicemque, doloris Capitis placandi gratiâ*; but first I presume they clean them well from the Poyson, which more than the irritation of the *Animal Spirits* might otherwise endanger the exciting most dreadfull pain's. I am confident in a *Nettle* there is not that irritation of Spirits and Fury, which yet to a considerable degree will (when assaulted) create pains and swellings; tho not so fatal as the other Poysons. For I am not yet so fully convinc'd (tho I have a just Deference for Mounsieur *Charas*, and a due regard for his laborious Researches and Inquiries) of his sentiment of the Innocence of this Liquor; and what has had some weight with me, is a Relation I

m *Hook's Micrographia. Obs.* 25 p. 144. n *Rerum med. Novæ Hispan. Hist.* l. 9. c. 17. p 328. Johnson *de Serpent.* l. 1. p. 27.

lately had from an Intelligent and knowing Person ; who informed me , That being in the *Indies* , there came to him, and his Company, an *Indian* with several sorts of Serpents, and offered to shew them some Experiments about the force of their Poyson, and the difference of them, and that this Practice is common with them : having therefore first pull'd out a large One, the *Indian* told him that this would do no harm ; therefore making a Ligature on his Arm, as they do in letting blood, he exposed it naked to the Serpents, having first whipt and irritated him to make him bite it. The blood that came out of the wounds made by his Teeth he gather'd with his Finger, and laid it on his naked Thigh till he had got near a Spoonful. After this he takes out another call'd *Cobras de Cabelo*, which was lesser, and enlarges much upon the greatness of it's Poyson ; and to shew them in part an Instance of it , grasping it about the Neck , he expressees out some of the Liquor in the *Raggs* of the *Gums* about the Quantity, as he thought, of $\frac{1}{2}$ a graine , and this he puts to the coagulated Blood on his Thigh , which as soon as mixt with it straight put it into a great Fermentation, and working like Barme changed it into a Yellowish Liquor. The same has been likewise observed by others, and does seem to give us some light , how 'tis that this Poyson acts and confirms the known^o observation , that the biting of a *Viper* will cause the yellow Jaundice. A present Antidote for this Poyson is said to be the Snake stone , *Pierre de Cobras de Cabelo* 'tis called by the *Portugueses* , and is famous all over the *Indies* ; 'tis described by *Garcias ab Horta*, by *Kircher* and others ; particularly by ^p Senior *Redi*, who renders very much suspected the Relations that are commonly had of it's great force and Virtue ; for in an abundance of Experiments which he made with it, he could never meet with any happy success : and altho the Tryal happened otherwise to Father *Kircher* in a Dog ; and

o De le Boe Sylvij *Frax. Me.* L. 1. c. 47. p Fr. Redi Experimenta circa Res Nat. p. 5. &c.

Charolus Magnini in a man at *Rome* where both did well; yet he ascribes it rather to the force of Nature, than the Stone, that was able stoutly to withstand and conquer the weak force of the Poyson. Indeed I must acknowledge the saying of *Hippocrates* to be true, *ἡ φύσις ἐναντίον ἑξουσίας ἐμπειρίας* *Experientia fallax, judicium difficile*, and there is nothing more common, then imposing upon our selves an *Elenchus non Cause pro Causa*. That it should always succeed, may as justly be questioned, as that it should allways faile; and that it does not the latter, some Accounts I have had of Persons relieved by it here in *England*, make me think so. One instance is remarkable, that was told me by an Eminent Physitian in *London*, of a Person near the Town that was bit by a *Viper*; his Hand and Arm soon swelled with great Extremity of Paine; but upon the Application of this Stone for one Night both were aswaged; and he thought himself well, and took of the Stone, which still did firmly adhere: but not long after his former *Symptoms* violently returning, he had recourse to his *Antidote*, and then suffered it to continue there 'till it fell of it self, and so was cured. Other Tryals likewise the same Physitian has made of it in different cases; and he thinks it has done him some service. One I shall mention, I formerly did my self, in a Patient troubled with the *Gout* in her *Stomack*, having removed it thence, it seized her *Toe*; but she being impatient of the Pain, that I might seem to do something, and to hinder her using abundance of Medicines, which every body was ready to advise her to, and might be apt to strike it to her *Stomack* again, I thought of this; holding the Stone therefore in my hand, and without acquainting her, I put it near the joynt where her pain was most; and being very near it, I perceived it move out of my hand, and readily adhere to the

part. Soon after she acquainted me, that she very sensibly perceived a great drawing and trickling all down her Leg and Thigh; and afterwards owned an abatement of her Paine. In Pestilential Swellings very probably it may be of use. But *I* have already too far digressed and shall now go on in finishing my Account of the Anatome of the *Rattle-snake* in describing the *Skeleton*, and shall make amends for my former prolixness by being more concise and short in this.

And first of the *Bones* of the *Head*. I observed that
 Fig. c. a. the * *Cranium* here was entire, without *Sutures*, as represented in our Figure: only where some other Bones were joyned to them, as forwards over the *Nostrils*, were two * small Bones, to which were fastned the || *Cartilages*, or rather Bones which divide the *Nose*. The other *Bones* seemed admirably contrived for the great Extension, and widening of the *Maxilla*; which seems a great provision of Nature; for since it must swallow all things whole, and its Head is but small, without this most Mechanical contrivance it were impossible to do it. The
 * c. c. || d. *Upper Jaw* forward was joyned to the *Bone* that recieves the Poysonous *Fange*; and which had a large *Cavity* in it, which opened outward, and was thought to be the * *Foramen* of the *Ear*; but inwards we observed no perforation for a *Nerve*, unless there might be one that comes to
 * Fig. s. b. it under that † *Bone* which conjoynes it to the *Cranium*. This Articulation seems advantagious, both for the motion of the *Fang*, which lyes sometimes couch'd, sometimes erected; as the *Jaw* too: but its principal and most remarkable advantage for Swallowing large bodies, is the curious Articulation of the *Maxilla* backwards to the *Cranium*, by two *Bones*, which from their use (since we know no Name to distinguish them by) we shall call *Maxillarum Dilatores*. Their shape, bigness, and aptness for this motion will readily enough be conceived by the
 † Fig. 6. c. c. Eye, in observing the Figure. □ For the lower *Jaw* being

not conjoyned at the *Mentum*, as is usual in other Animals, but parted at a good distance; upon the receiving a large body; as the Membrane here to which they are fastened easily extends, so by lifting up, as also by bringing these two Bones more to a strait line, it must needs considerably widen the *Rictus* of the Mouth: and for this cause too they are made two, not one, for performing this motion more easily. This Articulation* of the *Dilatatores* (which is very curious) with the upper and lower Jaw, makes those protuberances of the Head, which we liken'd to that of a Bearded Arrow, as do's the Poet, it may be upon the same account as well as its swiftneſs, where he saith

* m

*Rumpat & Serpens iter institutum,
Si per obliquum similis Sagittæ
Terruit Mannos.*

The lower Jaw of each side was composed of two Bones, as appears in the Figure, but firmly conjoyned. The fore Bone was for recieving the small teeth, the hinder towards the Articulation grew broad; as likewise did the Bone of the upper Jaw answerable to this place in the lower. But this upper Jaw towards the poysonous Fang divided into two Bones; One was fastened to the Bone of the poysonous Fang outwards; the other, which reciev'd the small teeth was inserted into the same Bone more inwards.

The *Vertebræ*, according to the whole Figure of the body, were smallest towards both extreems, and largest in the middle. From the Neck to the *Anus* there were as many observed Scales on the Belly, viz. 168. but from the *Anus* to the setting on of the *Rattle* 29 more in number than the Scales. The former *Vertebræ* had a flat † upright Spine towards the back; and a slender * round oblique descending one inwards to the belly. To each *Vertebra*, besides those

† Fig. 8. a.
b

* c. d those *Spines* just mentioned, there were other * *Processus*'s for the advantage of setting on of the Ribs, and the Articulation with one another; but what was most remarkable is (what I have already hinted) that round
 † c. † Ball in the lower part of the upper *Vertebra*, which enters a socket of the upper part of the lower *Vertebra*, like as the head of the *Os Femoris* does the *Acetabulum* of the *Os Ischij*; by which contrivance, as also the Articulation with one another, they have that free motion of winding their bodies any wayes. The Ribs in the Neck were small, but larger towards the middle of the body, where they were about 2 Inches long; but towards the Tail they grew lesser and shorter again, and did all terminate at the beginning of the Scales of the belly. In the *Vertebrae* of the
 * Fig. 9. b b Tail inwards there were two * *Spines*, whereas in the other *Vertebrae* there was but One; as likewise there were here transverse slender || *Processus*'s something analogous to Ribs.

To the last *Vertebra* of the Tail was fastened the * *Rattle*; in our Subject there was but 5, but some others seemed to be broken off. That next the Taile was of a lead-colour; the others of a cinericeous. 'Tis well described by * Dr. Grew, who says: 'They are very hollow, 'thin, hard, and dry bones; and therefore very brittle, 'almost like glass; and very sonorous. They are all very near of the same bulk, and of the self same figure; 'most like the *Os sacrum* of a man: for altho the last of them 'only seems to have a rigid Taile, or *Epiphysis* adjoynd 'to it, yet have every one of them the like; so as the 'Taile of every uppermost bone runs within two of the 'bones below it; by which artifice they have not only a 'moveable coherence, but also make a more multiplyed 'sound; each bone hitting against two others at the same 'time.

The use of this *Rattle* (since I know no other) I shall give in the words of *Gulielm. Piso*, who tells us; *Huius tam pernicioso Colubro, benigna natura cautionis quasi grat-*

tiâ crepitaculum addidisse videtur; ut illius Sonitu admonitus quilibet homo non solum, sed & quaecunque Pecus, vel Jumentum, tempestivè sibi caveat à vicino Hoste. But why he should make it so dangerous, if thrust into a mans Fundament (which how it can I don't well see) as to be more fatal than the poison of his Teeth; I know no reason. Both he and *Nierembergius* and others do assert, that every year there is an addition of a new *Rattle*, which Dr. *Grew* suspects, for then he must live 16 years, for so many joynts there are observed in some in our Repository; I have been told in some there have been above 20. These Rattles are placed with their broadest part perpendicular to the body, not Horizontal. And the 1. is fastened to the last *Vertebra* of the Taile by means of a thick * Muscle under it, and by the membranes that conjoyn it to the Skin. I have not given the figure of the whole Sceleton, since what is wanting may be sufficiently understood by the description; and whoso pleases may view the Sceleton it self, in the Repository of the Royal Society, very curiously prepared by that ingenious young Gentleman *Rich. Waller* Esq; a worthy Member of the Society; whose great assistance to me, I must hear gratefully acknowledge; as to the Designs; and otherwise: his curious Pensil illustrating what my Pen was often less able to describe.

* Fig. x. b

[Guil. Piso de *India* utriusque re Nat. & med. l. 5. c. 2. p. 374

THE EXPLANATION OF THE FIGURES.

FIGURE I.

Represents that part of the body opened, which contains the *Lungs*, the *Heart*, the *Gullet*, *Stomack*, &c.

- a a a *The Arteria aspera, or Windpipe.*
- B *The upper part of the Lungs, which is Vesiculous.*
- c c c c c *The lower part of the Lungs, which makes a large Bladder.*
- d *The first swelling^{or} Oesophagus, or false stomach.*
- e e e *The Oesophagus or Gullet, and that part of it, where'tis
 straiter.*
- f *The second swelling of the Oesophagus, or second false
 stomack.*
- g *The true Stomack.*
- h *A short straightening of the Gut, a little below the Pylorus.*
- i *The Intestines.*
- k *The Heart.*
- l *The Auricle.*
- m m m *Three Arteries, whereof there are Two Ascending, and One
 Descending.*
- n n n *Three large Veins, whereof two are descending, and the third
 ascending, which last does seem to divide the Liver into
 two Lobes.*
- o o *The Liver.*
- p *The Gall-bladder.*
- q *The Spleen, as 'tis call'd by the Antients; but by Charas the
 Pancreas.*

- r r r *A large Blood-vessel, that runs in the midst of the Scales of the belly.*
 s s *The Muscles belonging to the Scales of the belly.*

FIGURE II.

Shews those parts, that are contained in the lower part of the body.

- a *The Intestines cut off just below the Pylorus.*
 b *The Gall-bladder.*
 c *The Ductus Biliaris, that passes through the middle of the Spleen, or as call'd by Charas, the Pancreas; and enters the large Gut.*
 d *The Spleen, or Pancreas.*
 e e *The Intestines which was very large and winding but short.*
 f f *The Rectum.*
 g *The Anus.*
 h h *The Testes.*
 i i i *The Vasa Deferentia.*
 k k *The Penes on each side, which first at the Root are conjoynd and are thick be set with Bristles*
 l l *The Muscles that serve for the drawing in the Penes.*
 m m *The Sent. baggs.*
 n n *A large Blood-vessel that runs on one side of the left Kidney.*
 o o o *The Emulgents that arise from the same.*
 p p p *The Secretory vessels.*
 q q *The large Blood-vessels of the right Kidney.*
 r r r *The Emulgents arising from it.*
 s s s *A round body of Blood-vessels.*
 t t t *Secretory vessels.*
 u u *The Ureters.*

FIGURE III.

Represents the *Penes* of one side of a *Viper*.

- a *The Vas deferens, which afterwards divides, and runs to the end of the Penes.*
 b *The Penes.*
 c *The Muscles which retract the Penes in.*

FIG.

FIGURE IV.

Represents part of the *Lungs* opened by the *Trachea*.

- a a a a. The *Asteria Aspera*, divided in the middle.
- b b b. Some larger branches of *Blood vessels*.
- c c c. The *Vesiculæ*, or cells of the *Lungs*.

FIGURE V.

Exhibites the Head of the *Rattle-Snake*, with its mouth opened to shew his *Teeth*, and other parts there.

- a. The hole of the *Nostril*.
- b. The *Foramen* which leads to a large *Cavity*, which has no *Perforation* for any *Nerve* inwards, but yet tis thought to be for hearing.
- c c. The small *Teeth* in the upper *Jaw*.
- d d. The large *Fangs*, or *poysonous Teeth*.
- e e e. The place where the *Bladders* of *Poyson* lye.
- f. The *Larynx*.
- g. The forked *Tongue*.
- h. The *Teeth* in the lower *Jaw*.
- i. The place where the lower *Jaw* is divided at the *Mentum*.

FIGURE VI.

Represents the *Scull*.

- a. The *Cranium* without any *sutures*.
- bb. The *Orbits* of the *Eyes*.
- cc. Two small bones over the *Nose*.
- d. The *Gristly* [or rather *Boney Sepimentum* of the *Nose*.
- ee. A small *Bone*, that lyes between the *Cranium*, and that bone, in which is fixt the *Poysonous Fang*.
- ff. A *Cavity* in that *Bone*, to which is fastened the *poysonous Fang*, whose *Outward Orifice* is represented in the *Fifth Figure* by the letter (b) and is thought to be the *Ear*.
- g. The large *Poysonous Fang*, which is fastened to the *Ear-bone*.
- h. The Other *Poysonous Teeth*, which are not fixt in the bone but to *Muscles*.
- ii. The *Upper Maxilla*, which contains the small *Teeth*.
- k k. One side of the lower *Maxilla*, with its double row of *teeth*, which in the middle seems to be joined by a *suture*.
- l. The *Distance* at the *Mentum*, between the two sides of the lower *Maxilla* or *Jaw*.

H

Where

- m m *Where the two Maxillæ are joined together backwards, and by a Tendon are fastened to another Bone, which from its use, and for distinction sake; we call Dilatores Maxillarum.*
- n n. *The Dillatores of the Jaws.*
- o o. *A short bone which joynes the Dilator's to the Scull or Cranium.*
- p. *The Vertebrae of the Neck.*

FIGURE VII.

Represents the Poysonous teeth.

FIGURE VIII.

Shews one of the Vertebrae of the Back.

- a. *The Outward spine of the Vertebrae, which is flat longways.*
- b. *The Inward Spine of the Vertebrae, which is round.*
- c. *A large flat Processus, for the Articulation of the Vertebrae.*
- d. *Small transverse Processus's for the setting on the Ribs.*
- e. *A round ball, like the head of the os Femoris, which enters a socket of the lower Vertebra, as that do's the Acetabulum of the Os Ischij.*

FIGURE IX.

Shews one of the Vertebrae of the Tayle.

- a. *The spine towards the Back.*
- b b. *The two inward spines.*
- c c. *The transverse Spines, Analogous to Ribs.*

FIGURE X.

Represents the Vertebrae of the Tayle and the musculous flesh which fastens the first Rattle.

- a. *The Vertebrae.*
- b. *The Muscle on which is fastened the Rattle.*

FIGURE XI.

Exhibits a single Rattle, which has three Joynts: the first and largest appears when conjoyned with Others; the two other serve for the fastening on the succeeding Rattles, and are covered by them.

FIGURE XII.

Shews the five Rattles as joined together.

Fig. 1.

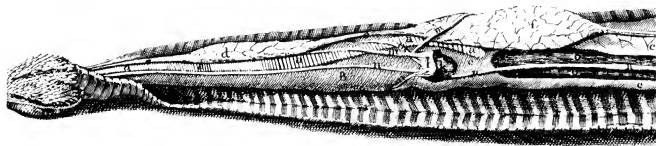


Fig. 2.

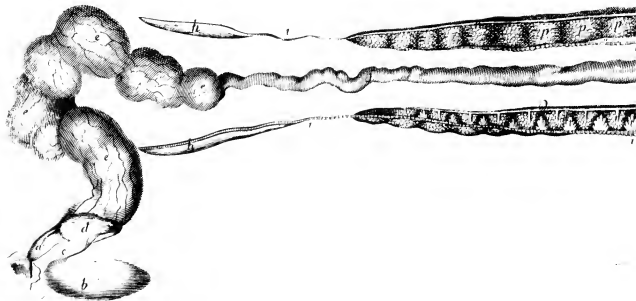


Fig. 1.

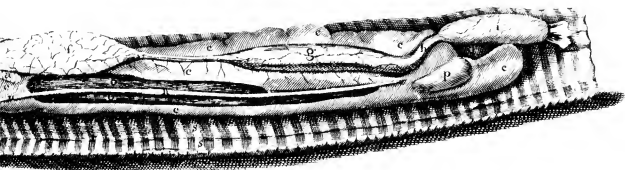


Fig. 2.

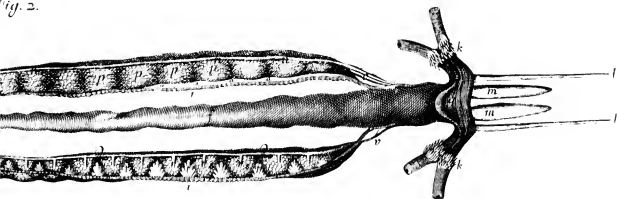


Fig. 4.

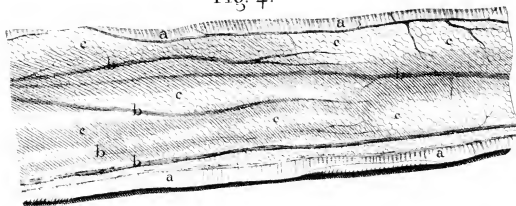


Fig. 5.

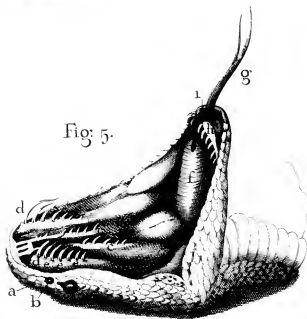


Fig. 6.

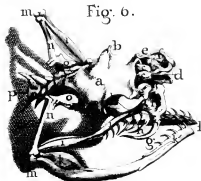


Fig. 7.



Fig. 8.



Fig. 9.



Fig. 10.



Fig. 11.



Fig. 12.



MBurg. sculp.

Thelaspis Transjuncta Verrill

Fig. 1



Fig. 2

